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Electromagnetic Valve

The present invention relates to an electromagnetic valve according to the preamble of patent claim 1.

DE 196 03 383 A1 discloses an electromagnetic valve of the mentioned type which, for attachment of the valve housing in the valve-accommodating member, includes a magnet end plate which has a clinched contour and on which a valve coil with a yoke ring is based. The magnet end plate additionally accommodates the open end of a dome-shaped sleeve part. The valve seat is secured to a cylinder insert which extends until a magnet armature into the sleeve part.

Consequently, the valve housing is composed of the cylinder insert which extends into the sleeve part and the valve seat secured thereto. In view of the press-in forces that act on the valve housing, the cylinder insert is manufactured from a massive turned part.

An object of the present invention is to manufacture an electromagnetic valve of the indicated type with least possible effort and structure and to provide a simple mounting support for this purpose, and another objective is to minimize the mechanical stress of the valve housing.

According to the present invention, this object is achieved for an electromagnetic valve of the indicated type with the characterizing features of patent claim 1.

Further features, advantages and possible applications of the present invention can be seen in the following from the description of several embodiments.

In the drawings,

Figure 1 is a cross-sectional view of a first embodiment of the electromagnetic valve of the present invention.

Figure 2 shows an embodiment of the object of Figure 1 in the area of the valve seat.

Figure 3 shows another low-cost integration of the valve seat in the valve housing.

Figure 4 shows a favorable embodiment of the above-mentioned electromagnetic valves by using an integral valve sleeve.

The embodiment of Figure 1 is a considerably enlarged view of a longitudinal cross-section taken through an electromagnetic valve having a valve housing which is composed of two sleeve parts 1, 2 made in a deep-drawing process and joined in one another so that an independent and operatively preassembled valve module is produced which, according to the drawings, accommodates a valve seat 5 and a ring seal 12 in the bottom second sleeve part 2. The valve module carries a magnet core member 6 in the first sleeve part 1 shown in the drawing. The ring seal 12 prevents a bypass flow between the two pressure fluid channels 13, 14 along the wall between the electromagnetic valve and the valve-accommodating member 4. The valve seat 5 and the magnet core member 6 are fixed in the walls of the sleeve parts 1, 2 by means of partial indentations 16.

Both sleeve parts 1, 2 with their end portions remote from the valve seat 5 and the magnet core member 6 are sectionwise slid into one another and undetachably connected from outside by means of laser welding in this overlapping area. In order to fasten the valve housing in the valve-accommodating member 4 of the drawings, the external first sleeve part 1 which projects over the second sleeve part 2 includes a retaining collar 3 which is reliably and pressure-fluid-tightly secured therein by an outside calked portion of the material of the valve-accommodating member 4. Instead of the illustrated outside calked portion 18, the retaining collar 3, if appropriate for welding operations, may also be welded to the valve-accommodating member 4.

The second sleeve part 2 further has a stepped portion 9 so that a ring filter 10 may be arranged in this area. Due to the thin wall of the second sleeve part 2 this ring filter 10 can be arranged both on the outside and the inside periphery of the sleeve part 2. When arranged in the area of the inside sleeve periphery, the ring filter 10 can additionally take over a guiding function for the tappet-shaped portion on the magnet armature. On the other hand, a corresponding deformation (waist) of the sleeve part 2 also permits achieving such a guiding function.

A magnet armature 7 that is adapted to the inside contour of the stepped valve housing 2 is thus movably arranged between the valve seat 5 and the magnet core member 6. In the basic position of the magnet armature, a spherical valve closure member 8 fitted to the magnet armature 7 bears against the valve seat 5 in a pressure-fluid tight manner under the effect of a compression spring 11 disposed between the magnet core member 6 and the magnet armature 7.

The pressure fluid connection via the pressure fluid channels 13, 14 which are arranged transversely and longitudinally to the valve axis in the valve-accommodating member 4 are interrupted in the electromagnetically closed basic position of the valve. In the electromagnetically energized valve operating position, there is an uninhibited pressure fluid connection by way of the open valve seat 5 and by way of the through-bore 15 which is disposed in the second sleeve part 2 at the level of the ring filter 10 between the two pressure fluid channels 13, 14. Upon request or requirement, the through-bore 15 may be configured as a calibration bore, which is e.g. made in a stamping process, and may thus perform an orifice function.

Different from the valve design according to Figure 1, Figure 2 shows the valve seat 5 designed as a valve plate and arranged within the second sleeve part 2, abutting on the said's sleeve bottom. The second sleeve part 2 is designed as a deepdrawn bowl and like in the sleeve periphery also includes a through-bore 15 in the sleeve bottom. The ring seal 12 is thereby positioned between the sleeve periphery, the ring filter 10,1 and the stepped bore of the valve-accommodating member 4. As regards the other valve details of Figure 2, reference is made to the above explanations with respect to Figure 1.

A particularly adept integration of the valve seat 5 in the second sleeve part 2 can be taken from Figure 3, according to which the contour of the valve seat 5 is indented directly into the sleeve bottom, preferably by means of a stamping process. All other valve details according to Figure 3 also correspond to the basic design of the electromagnetic valves of Figures 1 and 2 so that in detail the description of Figures 1 and 2 also applies to Figure 3.

If requested or required, it is, of course, possible upon to modify the embodiments explained above in their details in a

suitable fashion. One possibility is e.g. to arrange the ring filter 12 within the second sleeve part 2 due to the especially slim, thin-wall sleeve construction.

The inner cleanliness of the electromagnetic valve can still be improved by arranging another filter element in the area of the valve seat 5 so that due to the space-saving construction of the second sleeve part 2 e.g. between the bottom of the valve-accommodating member 4 and the valve seat 5 the intermediate space can be used by a plate-type filter 17.

Further, as is shown in Figure 4, the suggested dome-shaped design of the first sleeve part 1 may be omitted, if desired or required, and the magnet core member 6 will then adopt the function of a plug that closes the first sleeve 1. In Figure 4, the valve housing is configured as a one-piece sleeve part 1 which, different from the bowl shape of the sleeve part 2 according to Figures 2 and 3, extends with its extended sleeve stem until the plug-shaped magnet end part 6 so that the retaining collar 3 is represented as a separate deepdrawn part which is welded to the sleeve part. A form-locking attachment alternative is e.g. the so-called curling process and the inside pressure deformation for expanding the sleeve part 1 in the area of the retaining collar 3 which is then reinforced in its wall thickness due to the intensified stress.

The significant aspects of the present invention can be seen in that the valve housing 12 due to the retaining collar 3 chosen can be attached directly in the valve-accommodating member 4 in a calked fashion with minimum effort and structure. An optimal condition for laser welding of the outside surface of the sleeve part 1 with the second sleeve part 2 is achieved by the fact that the second sleeve part 2 which is slightly thicker than the first sleeve part 1 is positioned within the first sleeve part 1. The chosen construction also permits the use of

a hardenable material for the second sleeve 2 so that wear problems will not occur for the valve seat 5 when the said is placed directly in the bottom of the second sleeve part 2.

Using smallest wall thicknesses for both sleeve parts 1, 2 promotes the optimum design of the magnetic circuit.

List of Reference Numerals:

1	first sleeve part
2	second sleeve part
3	retaining collar
4	valve-accommodating member
5	valve seat
6	magnet core member
7	magnet armature
8	valve closure member
9	stepped portion
10	ring filter
11	compression spring
12	ring seal
13	pressure fluid channel
14	pressure fluid channel
15	through-bore
16	indentation
17	plate-type filter
18	outside calked portion

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Electromagnetic Valve

Abstract of The Disclosure

The present invention relates to an electromagnetic valve including a magnet armature, a magnet core member, a valve housing to which a valve coil is fitted and which accommodates a valve closure member and a valve seat. The valve housing is composed of a first sleeve part which is made in a deepdrawing process and, in the direction of a valve-accommodating member, includes a retaining collar that forms along with the sleeve part an independent, operatively preassembled module, and the sleeve part constituting a preferably undetachable connection, provided by laser welding, either in an overlapping area with the retaining collar and/or in an overlapping area with a second sleeve part.